
Question 78: In your experience, how effective and reliable are hydrocyclones, electrostatic separator, additives, and filters in reducing the ash content of the slurry?

Alec Klinghoffer (Coffeyville Resources)

There are basically 3 types of ways to reduce the ash content in slurry oil. They are electrostatic separators, additives with settling and filters. They all have their advantages and disadvantages, and they all do a reasonable job in reducing ash in slurry. I personally do not know of any refinery that uses hydrocyclones to remove ash from slurry oil. There are two major licensors of filters, Mott and Pall. Mott uses its HyPulse® LSI filters, which are back washable metal filters that contain tubular porous metal elements installed in a tubesheet at the bottom of a vessel. Feed slurry is introduced to the filter below the tube sheet and flows through the inside of the filter elements. Solids collect on the inside surface of the elements as filtrate passes through to elements to the outside surface. Accumulation of solids in the filter elements is followed by back flush to remove the solids as highly concentrated slurry. Mott claims in excess of 99.8% efficiency and several refineries have reported run lengths of close to 10 years without any significant issues. The literature suggests most of their installations are outside the United States. A very few, select refineries still use the Gulftronic separator. The separator is analogous to an ESP on the regenerator flue gas where an electrostatic field is used to remove particles from the slurry. The Gulftronic unit uses a clean and backwash cycle. In the clean cycle, the glass beads become ionized in an electrostatic field. A depletion zone is created because of a loss of ions on the surface of the beads. In the backwash cycle, the beads are fluidized, causing them to rub against each other and releasing the catalyst particles. In both applications, the stream with a high density of catalyst fines is recycled back to the riser. One independent refiner in the southwest US uses this to produce a slurry that is sold directly to a carbon black plant, and they report very few issues with the Gulftronic separator. A larger portion of US refineries either modify equipment to minimize catalyst losses in the slurry or they use a combination of additives and settling to separate particles from the slurry oil. Additives work by changing the electronic surface structure of the catalyst particle and allowing better particle agglomeration of the particle, so the particles become heavier and settle out of the slurry. For the most part, this tends to work in a wide range of applications and operating regimes, but Coffeyville has recently experienced a situation where additives did not have a significant impact in decreasing the ash content of slurry oil.

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